UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/540,826	06/24/2005	Shigeo Maruyama	1152-0313PUS1	8884

2292 7590 06/27/2008
BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

EXAMINER	
MARTINEZ, BRITTANY M	
ART UNIT	PAPER NUMBER
1793	

NOTIFICATION DATE	DELIVERY MODE
06/27/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/540,826	MARUYAMA ET AL.	
	Examiner	Art Unit	
	BRITTANY M. MARTINEZ	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *March 30, 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☒ Claim(s) *15* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 June 2005* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *6/24/2005 and 10/14/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Citation to the Specification will be in the following format (S. p. #, P) where # denotes the page number and P is the paragraph number. Citation to U. S. Patent literature will be in the format (Inventor, c. #, l. LL) where # is the column number and LL is the line number. Foreign patent literature will be in the format (Inventor, P) where P denotes the paragraph number.

Status of Application

Claims 1-19 have been examined.

Priority

1. The instant application is a national stage entry of PCT/JP03/17056, filed December 26, 2003. Acknowledgment is made of Applicant's claim for foreign priority in regard to JP 2002-382007, filed December 27, 2002. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

2. Should applicant desire to obtain the benefit of foreign priority under 35 U.S.C. 119(a)-(d) prior to declaration of an interference, a certified English translation of the foreign application must be submitted in reply to this action. 37 CFR 41.154(b) and 41.202(e).

Failure to provide a certified translation may result in no benefit being accorded for the non-English application.

Information Disclosure Statement

The listing of references in the Search Report is not considered to be an information disclosure statement (IDS) complying with 37 CFR 1.98. 37 CFR 1.98(a)(2) requires a legible copy of: (1) each foreign patent; (2) each publication or that portion which caused it to be listed; (3) for each cited pending U.S. application, the application specification including claims, and any drawing of the application, or that portion of the application which caused it to be listed including any claims directed to that portion, unless the cited pending U.S. application is stored in the Image File Wrapper (IFW) system; and (4) all other information, or that portion which caused it to be listed. In addition, each IDS must include a list of all patents, publications, applications, or other information submitted for consideration by the Office (see 37 CFR 1.98(a)(1) and (b)), and MPEP § 609.04(a), subsection I. states, "the list ... must be submitted on a separate paper." Therefore, the references cited in the Search Report have not been considered. Applicant is advised that the date of submission of any item of information or any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the IDS, including all "statement" requirements of 37 CFR 1.97(e). See MPEP § 609.05(a).

1. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a

separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Specification

2. The disclosure is objected to because of the following informalities: The last sentence of the instant specification is incomplete (S. p. 4, 0052).

Applicants are strongly encouraged to review the entire application for these mistakes, as well as spelling and grammar errors. Appropriate correction is required.

Drawings

1. The drawings are objected to because Figures 3-4 and 7 are not of sufficient quality for reproduction in a printed patent document. Refer to 37 CFR 1.84(b). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application

must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

2. Figure 6 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

3. **Claim 15** is objected to because of the following informalities: "grapheme" should be changed to "graphene." Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. **Claims 1-13 and 16-17** are rejected under 35 U.S.C. 103(a) as being unpatentable over Komatsu et al. (US 4,816,289) in view of Maruyama et al. (*Chemical Physics Letters*).

8. With regard to **Claim 1**, Komatsu discloses a process for producing a carbon filament by a vapor deposition technique, comprising: a step of spraying a solution prepared by dissolving an organic metal compound in an organic solvent into a furnace of a rare gas atmosphere (Komatsu, c. 17, l. 28-46; c. 18, l. 5-8 and 65; c. 19, l. 1-4), a step of vaporizing the organic metal compound and the organic solvent each described

above by heating the sprayed solution (Komatsu, c. 18, l. 8-12 and 30-38), a step of heating and decomposing the vaporized organic metal compound to obtain metal and heating and decomposing the vaporized organic solvent with the metal described above being used as a decomposition catalyst to obtain carbon atoms and a step of growing a graphene sheet using the carbon atoms obtained (Komatsu, c. 24, l. 9-12).

9. With regard to **Claims 2-3**, Komatsu discloses a pressure in the furnace controlled at 10^{-3} to 5 atm (Komatsu, c. 21, l. 52-57).

10. With regard to **Claims 6-7**, Komatsu discloses ferrocene as the organic metal compound (Komatsu, c. 14, l. 36).

11. With regard to **Claim 8**, Komatsu discloses the organic metal compound contained in the solution prepared by dissolving the organic metal compound in the organic solvent having a concentration of 0.01 mass% (Komatsu, c. 9, l. 15-17).

12. With regard to **Claim 9**, Komatsu discloses the solution being pressurized by an inert gas being sprayed through a nozzle having an aperture diameter of 0.01 mm (Komatsu, c. 19, l. 49-51).

13. With regard to **Claims 12-13**, Komatsu discloses a heating temperature for heating and decomposing the organic solvent and the organic metal compound being 400 to 3000°C (Komatsu, c. 13, l. 41-43).

14. With regard to **Claim 16**, Komatsu discloses argon or helium as the inert gas (Komatsu, c. 25, l. 1-7).

15. With regard to **Claim 17**, Komatsu hydrogen gas being mixed with the inert gas (Komatsu, c. 25, l. 1-7).

16. Komatsu does not explicitly disclose single-walled carbon nanotube (**Claim 1**); alcohol as the organic solvent (**Claim 4**); ethanol as the alcohol (**Claim 5**); an inert gas having a back pressure of 100 to 1000 Torr (**Claim 9**); a heating temperature for vaporizing the organic solvent and the organic metal compound being 50 to 600°C (**Claim 10**); a heating temperature for vaporizing the organic solvent and the organic metal compound being 100 to 400°C (**Claim 11**); or 5 mass % or less of hydrogen gas being mixed with the inert gas (**Claim 17**).

17. With regard to **Claims 1, 4-5, and 12-13**, Maruyama discloses a process for producing single-walled carbon nanotubes from ethanol by a vapor deposition technique using floated catalyst particles coalesced from ferrocene at 800^{o}C (Maruyama, "Abstract; p. 229, 2nd column; p. 230, 2nd column, "Results and discussion;" p. 233, 2nd column; p. 234, 1st column).

18. With regard to **Claim 9**, in view of *In re Boesch*, the claimed numerical back pressure limitation is considered to be a result effective variable and therefore may obviously be predetermined and optimized at the time the invention was made by one having ordinary skill in the art.

19. With regard to **Claims 10-11**, in view of *In re Boesch*, the claimed numerical heating temperature range limitations are considered to be result effective variables and therefore may obviously be predetermined and optimized at the time the invention was made by one having ordinary skill in the art.

20. With regard to **Claim 17**, an expected component mass % is a result effective variable since one of ordinary skill in the art would expect different properties in the

product as such % varies. Since the component mass % is a result effective variable, it is within the ordinary skill of one of ordinary skill in the art to develop a suitable hydrogen gas mass %. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

21. **Claims 14-15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Komatsu et al. (US 4,816,289) in view of Maruyama et al. (*Chemical Physics Letters*), as applied to **Claims 1 and 10-13** above, and further in view of Nikolaev et al. (*Chemical Physics Letters*).

22. The aforementioned applied prior art does not explicitly disclose a temperature for growing the graphene sheet being lower than a temperature of heating the organic solvent (**Claims 14-15**).

23. With regard to **Claims 14-15**, Nikolaev discloses a temperature for growing a graphene sheet being 600-700^{o}C, which is lower than 800-1200^{o}C, which is the temperature of heating the organic solvent (Nikolaev, "Abstract;" p. 92, 2nd column).

24. Thus, it would have been obvious to one of ordinary skill in the art to modify the process of the aforementioned applied art with the temperature difference taught by Nikolaev because there would have been a reasonable expectation of success.

25. **Claim 18** is rejected under 35 U.S.C. 103(a) as being unpatentable over Komatsu et al. (US 4,816,289) in view of Maruyama et al. (*Chemical Physics Letters*), as applied to **Claim 1** above, and further in view of Moy et al. (US 6,221,330 B1).

26. The aforementioned applied prior art does not explicitly disclose the grown graphene sheet being collected by a membrane filter (**Claim 18**).

27. With regard to **Claim 18**, Moy discloses a process for producing single-walled carbon nanotubes via the gas-phase reaction of a carbon source and a metal containing compound, wherein the resultant grown graphene sheet is collected on a quartz wool plug (Moy, "Abstract;" c. 4, l. 40-45). Further, a membrane filter is an obvious variant of a quartz wool plug.

28. Thus, it would have been obvious to one of ordinary skill in the art to modify the process of the aforementioned applied art with the nanotube collecting means taught by Moy because there would have been a reasonable expectation of success.

29. **Claim 19** is rejected under 35 U.S.C. 103(a) as being unpatentable over Komatsu et al. (US 4,816,289) in view of Moy et al. (US 6,221,330 B1) and Ohsaki et al. (US 6,878,360 B1).

30. With regard to **Claim 19**, Komatsu discloses equipment for producing carbon filament by a vapor deposit technique, comprising: a nozzle (Komatsu, "Fig. 4," (20); "Fig. 5," (40); "Fig. 8," (6)) for spraying a solution prepared by dissolving an organic metal compound in an organic solvent by pressurizing with an inert gas having a prescribed back pressure (Komatsu, c. 17, l. 28-46; c. 18, l. 5-8 and 65; c. 19, l. 1-4), a pre-heating part for vaporizing (Komatsu, "Fig. 1," (6)); the organic metal compound and the organic solvent each described above by heating the sprayed solution (Komatsu, c. 18, l. 8-12 and 30-38), a main heating part for heating and decomposing the organic

metal compound vaporized in the pre-heating part and heating and decomposing the organic solvent vaporized in the pre-heating part with the metal obtained by heating and decomposing the organic metal compound being used as a catalyst, and a growing part for growing a graphene sheet using carbon atoms obtained by heating and decomposing the solvent described above in the main heating part (Komatsu, c. 24, l. 9-12; "Fig. 1," (7)).

31. Komatsu further discloses control of process component introduction temperature at the end of the nozzle and the center temperature of the furnace (Komatsu, c. 28, l. 68; c. 29, l. 1-2); the use of inert carrier gases to introduce the process mixture into the heating/growing zone (Komatsu, c. 24, l. 64-68; c. 25, l. 1-7); and a heating temperature for heating and decomposing the organic solvent and the organic metal compound being 400 to 3000°C (Komatsu, c. 13, l. 41-43).

32. Komatsu does not explicitly disclose single-walled carbon nanotube (**Claim 19**); a first controlling means for heating and maintaining a temperature of the furnace in the pre-heating part at 50 to 600°C (**Claim 19**); a second controlling means for heating and maintaining a temperature of the furnace in the main heating part at 550 to 1000°C (**Claim 19**); or a third controlling means for maintaining the pre-heating part, the main heating part and the growing part in a rare gas atmosphere.

33. With regard to **Claim 19**, in view of *In re Boesch*, the claimed numerical heating temperature range limitations are considered to be result effective variables and therefore may obviously be predetermined and optimized at the time the invention was made by one having ordinary skill in the art.

34. With regard to **Claim 19**, Moy discloses an apparatus for producing single-walled carbon nanotubes via the gas-phase reaction of a carbon source and a metal containing compound, comprising a first controlling means for heating and maintaining a temperature of the furnace in the pre-heating part at 70-80°C (Moy, c. 4, l. 25-28; c. 6, l. 6-8); and a second controlling means for heating and maintaining a temperature of the furnace in the main heating part at 900°C (Moy, c. 4, l. 29-34; c. 6, l. 3).

35. With regard to **Claim 19**, Ohsaki discloses an apparatus for the production of vapor-phase growth of carbon nanofibers, comprising a controlling means for maintaining the apparatus in a rare gas (argon) atmosphere (Ohsaki, c. 7, l. 4-6 and 9-10; c. 14, l. 41-42).

36. Thus, it would have been obvious to one of ordinary skill in the art to modify the apparatus of the aforementioned applied art with the controlling means taught by Moy and Ohsaki because there would have been a reasonable expectation of success.

Conclusion

1. No claim is allowed.

2. In general, prior art renders the claimed invention obvious.

3. Applicant is required to provide pinpoint citation to the specification (i.e. page and paragraph number) to support any amendments to the claims in all subsequent communication with the examiner. **No new matter will be allowed.**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRITTANY M. MARTINEZ whose telephone number is (571) 270-3586. The examiner can normally be reached on Monday-Thursday 7:00AM-5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Wayne Langel/
Primary Examiner, Art Unit 1793

BMM

/Brittany M Martinez/
Examiner, Art Unit 1793